MYCOPLASMA

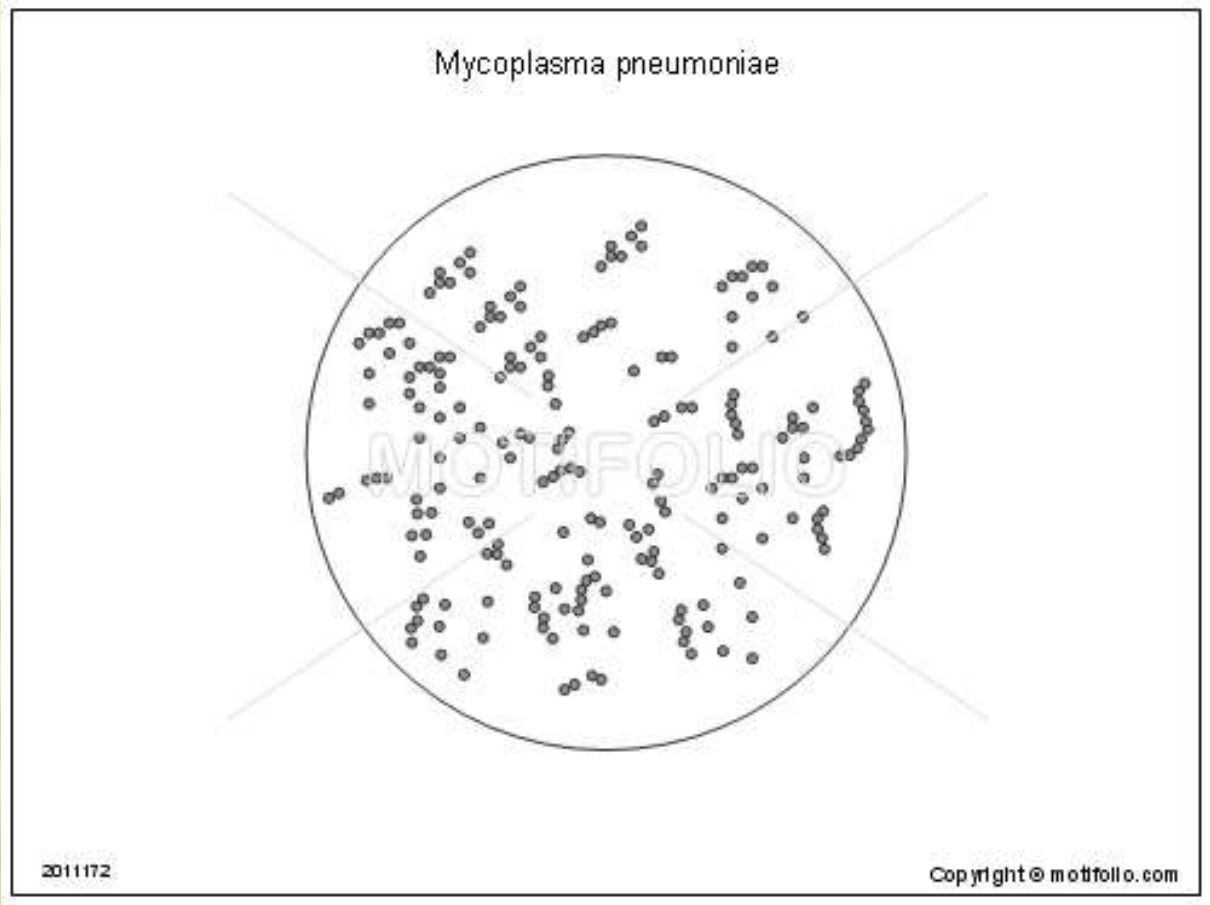
INTRODUCTION

- In 19th century (1898) when two French scientists studying the pleural fluids of cattle suffering from a disease called bovine pleuropneumonia discovered some microorganisms that were totally different from the ones known before.
- The disease was highly contagious and became widespread in Europe during the 19 th century.

- The disease causing organisms were different from bacteria and were given the name pleuropneumonia like organisms (PPLO).
- The first cultured forms were some times spheroidal in shape but also produced a wide variety of minute granular structures, thin branching filaments, asteroid structures or many irregular forms. Due to this the mycoplasma were called pleomorphic.

- Pathogenic forms of PPLO were reported from a wide variety of veterinary sources, human and plants.
- Many mycoplasmas are also found in saprophytic condition in decaying organic matter.

MYCOPLASMA PNEUMONIAE



GENERAL PROPERTIES OF MYCOPLASMA (PPLO)

- 1) They are the smallest free living organisms (about 125-250nm in diameter).
- 2) They can easily pass through bacterial filter.
- 3) They are highly pleomorphic- branched, beaded, swollen, ringed or even stellate. They may even be spherical, ovoid, filamentous (branched). Sometimes they resemble the hyphae of fungi in their morphology.

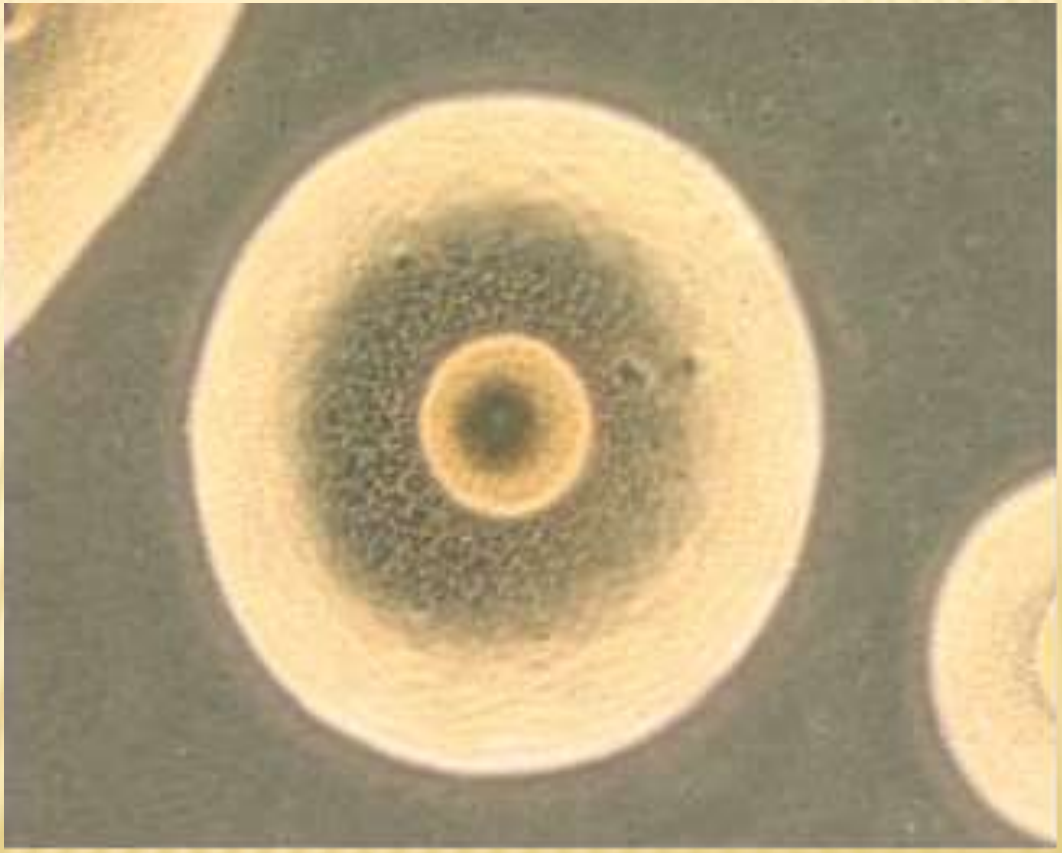
- 4) They lack a cell wall. The outer most boundary is a three layered plasma membrane.
- 5) They are either parasitic or saprophytic.
- 6) They can be cultured in a cell free medium with abundance of organic matter.
- 7) They are aerobic as well as anaerobic.
- 8) Some members (Mycoplasma) require sterol for growth while others (Acholeplasma)

  do not require it.

- 9) Some mycoplasma called ‘T’ strains mycoplasma require urea and require a lower pH for growth than others.
- 10) Ribosomes are present in the cell, but different from those of true bacteria.
- 11) Mycoplasmas are resistant to penicillin but sensitive to tetracycllins.
- 12) Specific details of reproduction not known. Reproduction may take place by elementary bodies, budding or binary fission.

- 13) Mycoplasmas are gram negative.
- 14) Spores, flagella etc. are absent.

FRIED EGG LIKE APPEARANCE



CLASSIFICATION

- Taxonomic position of PPLO was much under debate.
- They are also classified under class Schizomycetes

  (Bacteria) and order Mycoplasmatales, family Mycoplasmataceae and genus Mycoplasma.

- The International Committee on the bacterial nomenclature constituted a subcommittee to go into all aspects of mycoplasma systematics and offer suitable recommendations. Accordingly the subcommittee deliberated and gave the following suggestions:
- 1) The mycoplasma are not to be regarded as stabilized-L forms of bacteria (L forms of bacteria do not have cell walls like mycoplasma).

- 2) Considering their unique characters as different from bacteria and viruses, the mycoplasma be accorded the rank of a class- Mollicutes along with bacteria (Schizomycetes) .

  The class Mollicutes is divided into two orders-

  Mycoplasmatales and Acholeplasmatales each with a single family- Mycoplasmataceae and Acholeplasmataceae.

- There are only two genera, one belonging to each family. These are mycoplasma and Acholeplasma (Edward and Freundt, 1970). In addition to these two genera, two more genera of uncertain affinities are also included. These are – *Spiroplasma* and *Thermoplasma.*

- The main criteria for the distinction between Mycoplasmataceae and Acholeplasmataceae is the requirement of sterol for growth in the former and its requirement in the latter.

- Based on their physiological properties mycoplasma are classified into
- 1) Carbohydrate fermenting- non sterol requiring
- 2) Carbohydrate fermenting- sterol requiring
- 3) Non carbohydrate fermenting- non sterol requiring

- In the gps 1 & 2 above , acid is produced from sugars such as glucose, fructose mannose etc. The non fermenting sps. utilize amino acids and fatty acids as carbon and energy sources (eg. *Mycoplasma arthritidis*)

GENERAL CHARACTERS OF FAMILIES

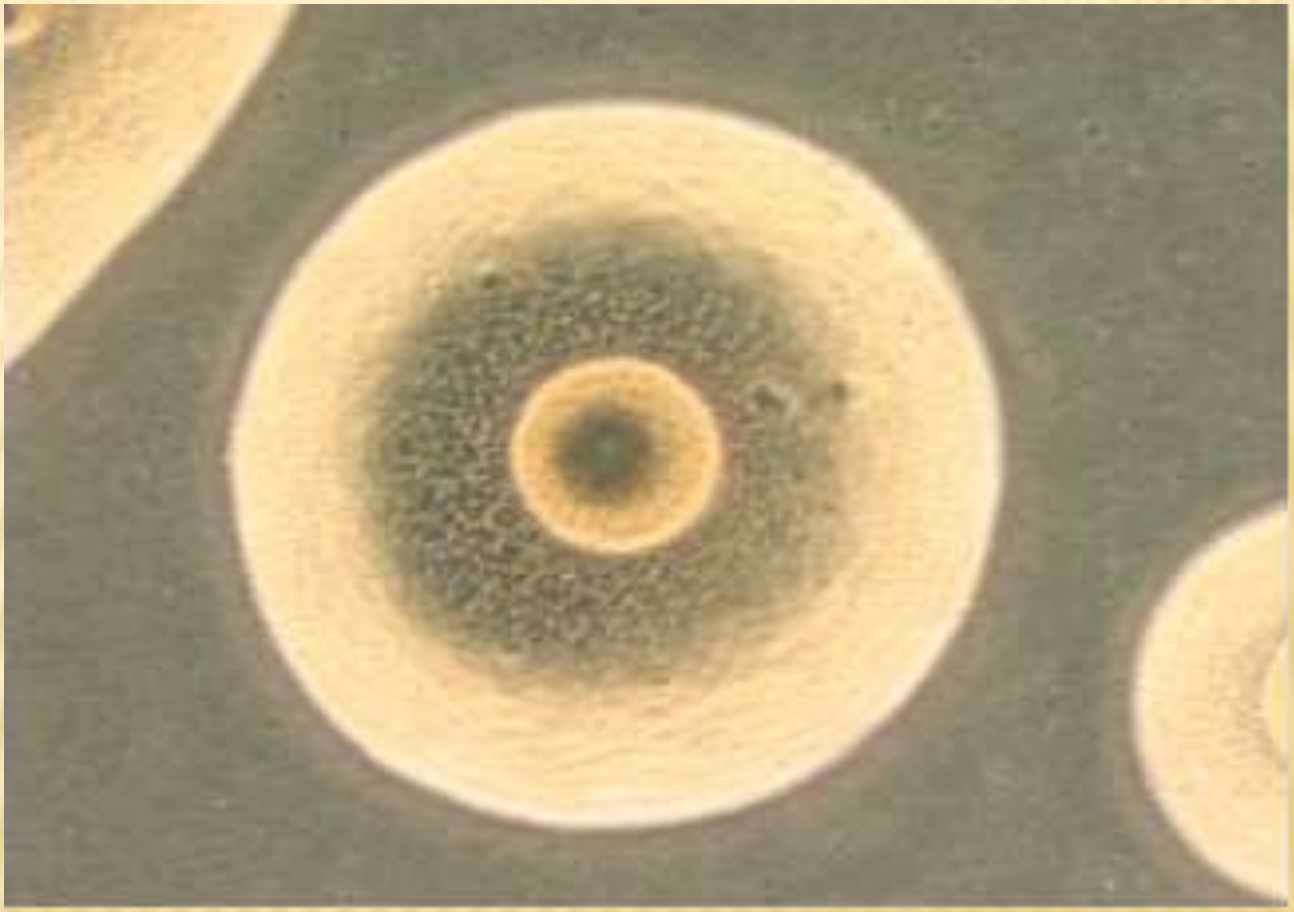
Mycoplasmataceae

1) They can grow only when sterol is added to the medium.
2) They can grow in a temperature range of 22 degree C to 41 degree celsius with optimum being 36-37 degree celsius.
3) A pH of 7.0 in ideal for their growth.
4) The GC content of DNA is 23-40%.
5) They are mostly animal pathogens (including human beings) rarely plant pathogens.

ACHOLEPLASMATACEAE

- 1) Members saprophytic, present in sewage: sterol not required for growth.
- 2) Require a temperature range between 37 C to 65 C with optimum being 59 C.
- 3) Acidic pH range is ideal (1-2).
- 4) They form typical “ fried egg” colonies on the medium.
- 5) The GC content of DNA is 25-26%.

FRIED EGG LIKE APPEARANCE



CELL STRUCTURE

- *Morphology & fine structure*

1. Mycoplasma cell cultures show short or long branching filaments with many spherical coccal bodies.
2. The morphology of the cell depends on the nutritive properties of the growth medium particularly the ratio of saturated fatty acid to unsaturated ones, thus affects the membrane structure.

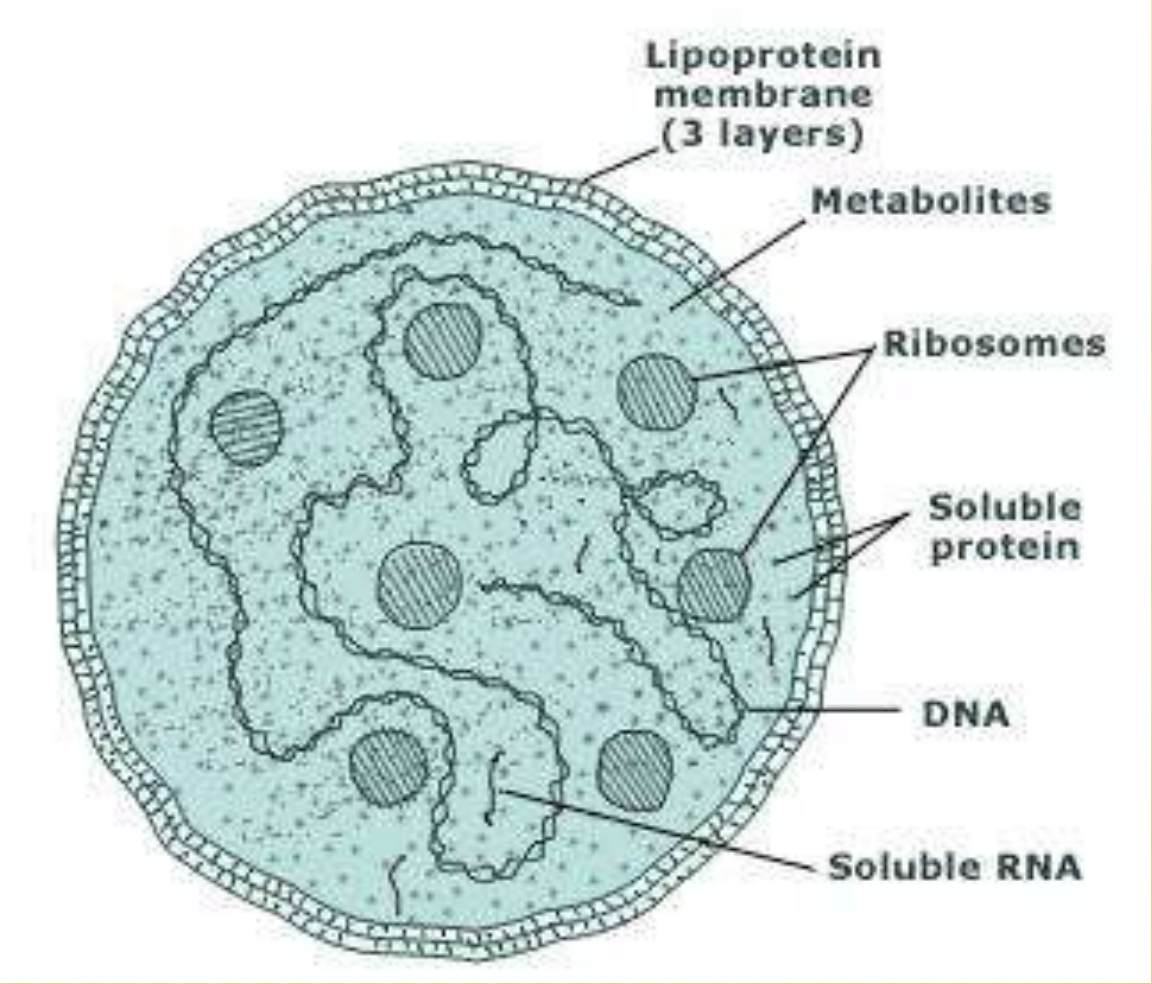
3. The size of the cell is about 125-250 nm. Some may reach a size of 0.5 to 1.0 micrometer.
4. The cell has no cell wall and locomotor organs. The lake of cell wall is responsible for its fragility and plasticity with which it can assume various shapes.
5. The outermost boundaries of the cell is a plasma membrane which is about 8 to 15 nm in thickness.

6. The membrane is triple layered with two electron dense layers separated by a translucent layer. The electron translucent layer is made up of long chain fatty acid while the electron dense part is made up of protein and carbohydrates.
7. The absence of cell wall offers immunity to mycoplasma from the antibiotics like penicillin and cycloserine which act on the process of cell wall synthesis.

8. In *Mycoplasma pneumoniae* there is a specialized area on the membrane called the ‘foot’ which attaches to the animal cell surface. A needle like structure is inserted into the cell through which Mycoplasma enzymes enter and digest the host cell metabolites.
9. There is no endoplasmic reticulum and well defined mesosome.
10. The cytoplasm has only two organelles- ribosomes and nuclear material.

11. The nuclear material is fibrillary in form and is either centrally placed or dispersed.
12. The DNA is naked and has no protein associated with it.

A GENERALISED CELL STRUCTURE OF MYCOPLASMA



REPRODUCTION

No sexual reproduction has been reported. A sexual reproduction is by means of simple fission or formation elementary bodies. There are also reports of binary fission budding in mycoplasma as in yeasts.

MYCOPLASMA AND L FORMS

Under various cultural conditions such as the presence of antibiotics like penicillin, cycloserine, bacitracin etc. cell wall synthesis in bacteria is affected. Either the bacterial colonies die or as it happens in some instances, they survive in the form of spheroplasts or protoplasts with modified cell wall or no cell wall. They multiply as variants of parent bacterium. Such wallless forms a bacteria are called L forms. (L phase).

They may be stable or unstable.

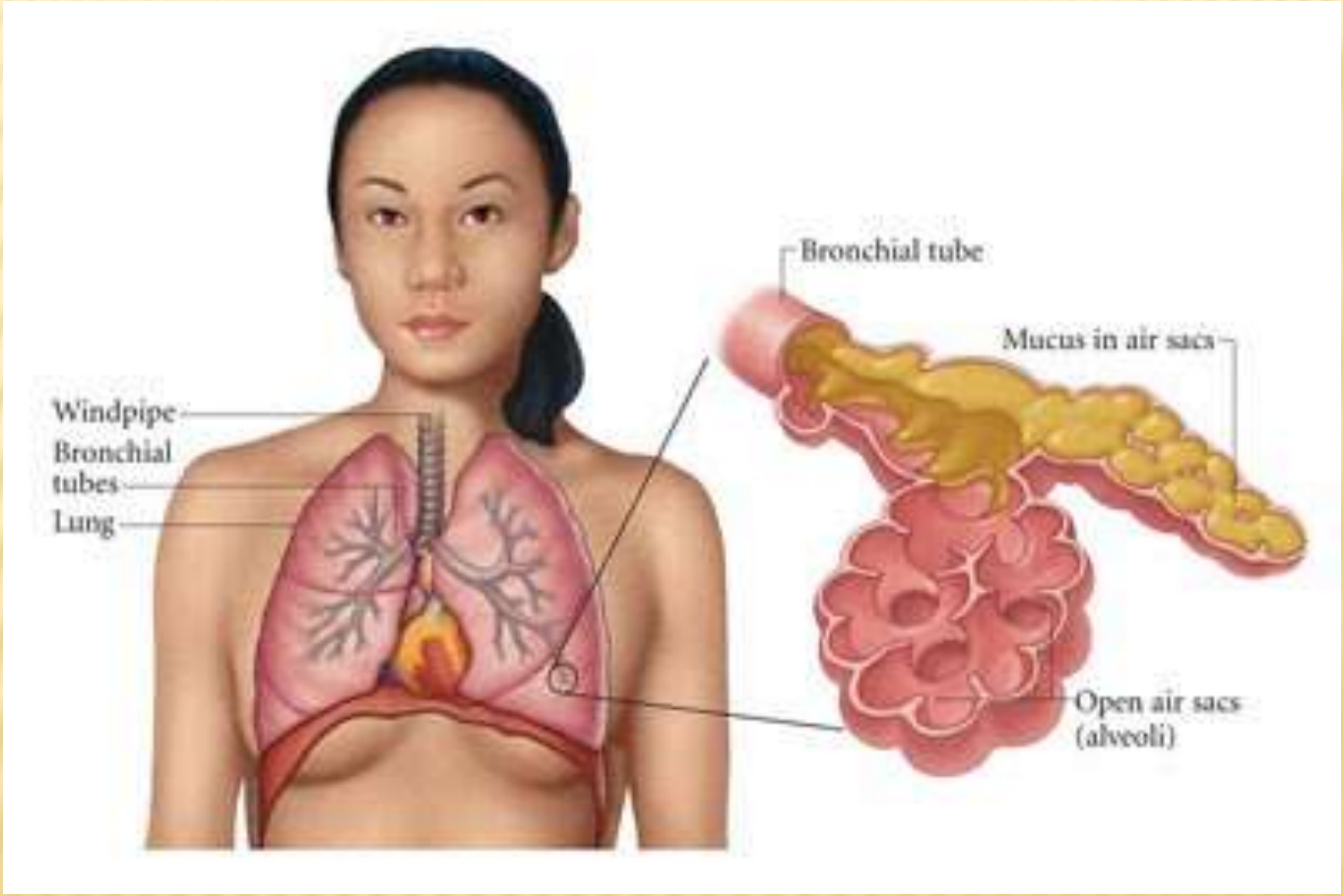
The colonies of L forms of bacteria have a striking similarity with mycoplasma colonies possibly because both of them lack cell wall.

ECONOMIC IMPORTANCE

Human mycoplasma

a) Consists of about 8 or 9 sps. – *M.hominis, M.salivarium, M.orale, M.fermentans, M.pneumoniae, M.primatum, T.strains etc.*
b) *M.pneumoniae* causes a typical pneumoniae, exhibts symptoms of febrile bronchitis, myalgia, headache, sore throat and cough.
c) *M.hominis* and 'T' strains of mycoplasma are involved in urinogenital infections.

PATHOGENESIS CAUSED BY *M.PNEUMONIAE*



ANIMAL MYCOPLASMA.

a) Bovine pleuropneumonia was the first mycoplasma diseases discovered.
b) Goat, sheep, rats, mice etc. are infected.

PLANT MYCOPLASMA

a) Some of the important plant diseases caused by mycoplasma are -

i. Aster yellow
ii. Potato witches' broom.
iii. Sandal spike.
iv. Corn stunt.
v. Dwarf disease of mulberry.
vi. Blue berry stunt.
vii. Little 'leaf of Brinjal'.
viii. Western x disease.

MYCOPLASMA VIRUSES

- A number of viruses are known to infect mycoplasma. These are called mycoplasma phages, first discoved in 1970 by Gourlay and Since then more than 75 viruses of mycoplasma has been reported.

COLONIES OF MYCOPLASMA

ASTER YELLOW DISEASE

POTATO WITCHES'BROOM OF CACTUS

LITTLE LEAF OF BRINJAL

- THANK YOU